

What Is Claimed Is:

1. A method of stir welding T-joints comprising:

assembling a first member to a second member, the first member comprising a thin sheet portion of material having opposite first and second faces and also comprising opposing restraining surfaces that are oriented at an angle relative to the first face of the sheet portion, the second member comprising a rib that has a terminal edge margin, the assembling comprising engaging the edge margin of the rib of the second member with the first member in manner such that the rib of the second member extends at an angle away from the first face of the first member and such that the edge margin is positioned between the restraining surfaces of the first member; and

stir welding the first member to the second member by engaging a stir welding tool against the second face of the first member, the stir welding occurring with the first and second members being assembled to each other in accordance with the preceding step of assembling the first member to the second member, the restraining surfaces of the first member limiting movement of the edge margin of the second member relative to the first member during the stir welding.

2. A method in accordance with claim 1 wherein the first

and second members are each formed as a single monolithic piece of contiguous material and wherein one of the first and second members comprises a tooling portion forming a portion of the monolithic piece thereof, the method further comprising  
5 securing the first and second members to a stir welding apparatus via the tooling portion during the step of stir welding the first member to the second member, and separating the tooling portion from the first and second members after stir welding the first member to the second member.

10 3. A method in accordance with claim 2 wherein the tooling portion forms a portion of the monolithic piece of the second member and forms a loop around the rib of the second member prior to being separated from the first and second members.

15 4. A method in accordance with claim 2 wherein the tooling portion constitutes a first tooling portion forming a portion of the monolithic piece of the one of the first and second members, and wherein the other of the first and second members comprises a second tooling portion forming a portion of the monolithic piece thereof, the method further comprising  
20 securing the first and second members to each other via the first and second tooling portions during the step of stir welding the first member to the second member, and separating the second tooling portion from the first and second members

after stir welding the first member to the second member.

5 5. A method in accordance with claim 1 wherein the restraining surfaces of the first member extend parallel to each other and form a groove therebetween, and wherein the step of assembling further comprises inserting the edge margin of the rib of the second member into the groove of the first member.

10 6. A method in accordance with claim 5 wherein the first member further comprises a pair of locking surfaces that oppose the first face of the sheet portion of the first member, the restraining surfaces of first member being positioned between the locking surfaces and the first face, and wherein the rib has opposite first and second faces and the edge margin of the rib comprises a pair of locking  
15 surfaces, the first and second faces of the rib being positioned between the locking surfaces of the rib, and yet further wherein the step of assembling further comprises engaging the locking surfaces of the first member with the locking surfaces of the second member in a manner limiting the  
20 movement of the rib away from the first face of the first member.

7. A method in accordance with claim 6 wherein the step of assembling further comprises resiliently deflecting the

locking surfaces of the first member away from each other as the edge margin of the rib of the second member is inserted into the groove of the first member, and allowing the locking surfaces of the first member to resiliently move toward each other in a manner such that the locking surfaces of the rib of the second member are positioned between the locking surfaces of the first member and the sheet portion of the first member.

8. A method of stir welding comprising:

forming first and second members from material, one of the first and second members comprising a tooling portion formed as a contiguous portion of the material of the respective member, the first member comprising a thin sheet portion formed as a contiguous portion of the material of the first member, the second member comprising a rib formed as a contiguous portion of the material of the second member, the rib having a terminal edge margin;

utilizing a stir welding apparatus to stir weld the edge margin of rib of the second member to the sheet portion of the first member in a manner forming a stir welded T-joint, the first and second members being secured to the stir welding apparatus via the tooling portion during the stir welding; and

separating the tooling portion from the first and second members after forming the stir welded T-joint.

9. A method in accordance with claim 8 wherein the forming of the first member occurs in a manner such that the sheet portion of the first member has opposite first and second faces and the first member further comprises opposing

5 restraining surfaces that are oriented at an angle relative to the first face of the sheet portion, and wherein the step of utilizing the stir welding apparatus to stir weld the edge margin of rib of the second member to the sheet portion further comprises positioning the edge margin of the rib  
10 between the restraining surfaces of the first member in a manner such that the restraining surfaces limit relative movement between the rib and the sheet portion.

10. A method in accordance with claim 9 wherein the opposing restraining surfaces of the first member extend  
15 parallel to each other and form a groove therebetween, and wherein the step of utilizing the stir welding apparatus to stir weld the edge margin of rib of the second member to the sheet portion further comprises inserting the edge margin of the rib of the second member into the groove of the first  
20 member.

11. A method in accordance with claim 10 wherein the step of forming first and second members further comprises forming a pair of locking surfaces on the first member that

oppose the first face of the sheet portion, the restraining surfaces of first member being positioned between the locking surfaces and the first face, and wherein the rib is formed with opposite first and second faces and a pair of locking surfaces on the edge margin thereof, the first and second faces of the rib being positioned between the locking surfaces of the rib, and yet further wherein the step of utilizing the stir welding apparatus to stir weld the edge margin of rib of the second member to the sheet portion of the first member further comprises engaging the locking surfaces of the first member with the locking surfaces of the second member in a manner limiting the movement of the rib away from the first face of the first member.

12. A method in accordance with claim 11 wherein the step of utilizing the stir welding apparatus to stir weld the edge margin of rib of the second member to the sheet portion of the first member further comprises resiliently deflecting the locking surfaces of the first member away from each other as the edge margin of the rib of the second member is inserted into the groove of the first member, and allowing the locking surfaces of the first member to resiliently move toward each other in a manner such that the locking surfaces of the rib of the second member are positioned between the locking surfaces of the first member and the sheet portion of the first member.

13. A method in accordance with claim 8 wherein the tooling portion forms a loop around the rib of the second member prior to being separated from the first and second members.

5 14. A method in accordance with claim 8 wherein the tooling portion constitutes a first tooling portion of the one of the first and second members, and wherein the other of the first and second members comprises a second tooling portion forming a contiguous portion of the material thereof, the  
10 method further comprising securing the first and second members to each other via the first and second tooling portions during the step of utilizing the stir welding apparatus to stir weld the edge margin of rib of the second member to the sheet portion of the first member, and  
15 separating the second tooling portion from the first and second members after forming the stir welded T-joint.

15. A method in accordance with claim 14 further comprising a step of aligning the first a second members with respect to each other via the first and second tooling  
20 portions.

16. A T-joint comprising:

a rib member having opposite first and second faces;  
and

a sheet member, the sheet member comprising a thin sheet portion of material having opposite first and second faces and also comprising at least two restraining surfaces that are oriented at an angle relative to the first face of the sheet portion, at least one of the restraining surfaces of the sheet member being engaged with the first face of the rib member and at least one of the restraining surfaces of the sheet member being engaged with the second face of the rib member, the sheet member being stir welded to the rib member.

17. A T-joint in accordance with claim 16 wherein the opposing restraining surfaces of the sheet member extend parallel to each other and form a groove therebetween, and wherein a portion of the rib member is positioned within the groove.

18. A T-joint in accordance with claim 16 wherein the sheet member further comprises a pair of locking surfaces that oppose the first face of the sheet portion, the restraining surfaces of the sheet member being positioned between the locking surfaces and the first face of the sheet member, and wherein the rib member comprises a pair of locking surfaces, the locking surfaces of the rib member being positioned between the locking surfaces of the sheet member and the first face of the sheet member.



19. A T-joint in accordance with claim 18 wherein the sheet member further comprises a pair of camming surfaces, each of the locking surfaces of the sheet member being positioned between one of the camming surfaces and the sheet

5 portion, the camming surfaces being oriented in a manner such that the camming surfaces converge toward each other as they extend toward the sheet portion of the sheet member.

20. A T-joint in accordance with claim 16 wherein the rib member extends perpendicular relative to the first face of

10 the sheet portion of the sheet member.